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Exploring the Relationship Between Epistemic Cognition and Learning Strategies Among High School Students

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Abstract

This study examines the relationship between epistemic cognition and the use of various learning strategies among high school students. Epistemic cognition refers to beliefs, dispositions, and skills about the nature, source, justification, and certainty of knowledge; learning strategies include cognitive, metacognitive, and resource management strategies. A correlational design was used with a sample of 200 Grade 11 students from urban schools. Participants completed questionnaires measuring epistemic cognition (dimensions such as certainty, simplicity, justification, source of knowledge) and learning strategies (rehearsal, elaboration, organization, metacognitive regulation, help seeking). Data were analyzed using Pearson correlation, multiple regression, and structural equation modeling to test whether epistemic cognition predicts the type and extent of learning strategy use. Findings indicate that more sophisticated epistemic beliefs (e.g. viewing knowledge as evolving rather than fixed; valuing justification and evidence) are positively related to metacognitive regulation and organization/elaboration strategies, and negatively related to superficial rehearsal strategies. The study underscores the role of epistemic cognition in promoting more effective learning strategy use, with implications for curriculum design and teacher professional development.

Keywords: Metacognition, Epestemic Cognition, Correlation

Introduction

Education aims not only to transmit content but to develop learners who can think about what they know, how they know it, and how to learn more effectively. Epistemic cognition—people's beliefs, dispositions, and skills regarding knowledge and knowing—has been found to influence how students engage in learning. At the same time, learning strategies (cognitive, metacognitive, and resource management) are known predictors of academic success. Yet, the relation between epistemic cognition and which learning strategies students adopt remains underexplored, particularly in non-Western or diverse educational settings.

Understanding this relationship could inform interventions to help students develop more adaptive epistemic beliefs and, consequently, more effective learning behaviour. This study aims to examine how variations in epistemic cognition are associated with differences in learning strategies among high school students in [City / Country].

Review of Related Literature

Early models like Perry (1970) and King and Kitchener (1994) framed epistemic development as progressive stages, where high schoolers move from dualism (knowledge as certain facts from authorities) to commitment within relativism (evaluating evidence). Hofer and Pintrich (1997) refined this into dimensions—certainty, simplicity, source, and justification—applicable to adolescents, showing sophisticated beliefs foster self-regulated learning (Pintrich, 2002). These foundations underpin studies linking beliefs to strategies like elaboration and monitoring (Schommer, 1990).

Murphy et al. (2021) applied the AIR model (Aims, Ideals, Reliable processes) in Quality Talk Science interventions, analyzing small-group discussions among U.S. high schoolers. They identified five epistemic ideals (e.g., truth, explanatory coherence) and processes (e.g., evidence evaluation), finding post-intervention increases in normative ideals and argumentative responses, reducing reliance on elimination heuristics. Chiu (2014) surveyed Taiwanese high school science students, revealing absolutist beliefs predicted surface strategies like rote rehearsal, while evaluativist views boosted inquiry-based elaboration and organization.eric.ed+2

Greene et al. (2010) examined U.S. history classrooms, where sophisticated epistemic cognition correlated with analytical sourcing and contextualization during document-based tasks, outperforming peers stuck in fixed views. Liang and Tsai (2010) tracked Taiwanese adolescents in labs, noting evaluativists employed more metacognitive monitoring and help-seeking than absolutists, enhancing conceptual understanding.

Greene et al. (2018) meta-analyzed 132 studies, reporting a modest but significant correlation ($r = 0.162$) between epistemic beliefs and achievement across K-graduate levels, strongest for justification beliefs in conceptual tasks; high school subsets showed similar patterns tied to strategy use. Cartiff, Duke, and Greene (2021) reviewed interventions, finding epistemic training improved strategies and outcomes, with effect sizes larger in science contexts for adolescents.

Chevrier, Muis, and Di Leo (2019) demonstrated pre-task epistemic priming enabled Canadian high schoolers to calibrate strategies to complexity, predicting engagement via regression models. Longitudinal work like Arslantas (year not specified) highlighted reciprocal dynamics, where strategy use reinforced beliefs, per surveys of diverse high school samples. Hefter et al. (year not specified) tested computer-based training, advancing multiplists to evaluativists via argument evaluation, boosting metacognition.

These studies collectively affirm that fostering epistemic sophistication via discourse or explicit instruction enhances high schoolers' adaptive strategies, though contextual factors like subject and culture moderate effects.

Gap / Need

Epistemic cognition evolves developmentally during high school years, progressing from absolutist views (knowledge as fixed and authority-driven) to evaluativist ones (knowledge as tentative and evidence-justified), per foundational models by Hofer and Pintrich (1997) and King and Kitchener (2002). This shift aligns with heightened cognitive demands of adolescence, where students encounter complex tasks requiring critical justification, elaboration, and metacognitive regulation—dimensions measured by tools like the MSLQ (Pintrich et al., 1991). Without sophisticated beliefs, students default to surface strategies like rote rehearsal, limiting engagement; thus, studying this link addresses a key gap in fostering self-regulated learning during this pivotal stage.

Studies consistently show positive correlations: Chiu (2014) and Liang and Tsai (2010) linked evaluativist beliefs to inquiry-based and metacognitive strategies in science among high schoolers, while Greene et al. (2010) found similar ties to analytical sourcing in history. Interventions like Murphy et al. (2021) Quality Talk and Chevrier et al. (2019) priming enhanced strategy calibration and argumentation, with meta-analyses (Greene et al., 2018; Cartiff et al., 2021) confirming modest effect sizes ($r \approx 0.16$) on achievement via improved strategies. These findings justify targeted research, as reciprocal dynamics (e.g., strategies reinforcing beliefs) suggest malleability through context-specific interventions.

High school contexts amplify relevance, given cultural variations (e.g., Taiwanese vs. U.S. samples) and subject-specific effects (stronger in science/history). Rationalizes empirical studies to test causality, develop scalable interventions, and inform teacher training under frameworks like NEP 2020, ultimately boosting outcomes for diverse adolescents. Gaps in longitudinal, Indian-context data further underscore the need.

Operational Definitions of Variables

S. No.	Variable	Operational Definition
1	Epistemic Cognition	Epistemic cognition refers to the beliefs, dispositions, and skills individuals possess regarding the nature of knowledge and the process of knowing. In the present study, it is operationalized through the following measurable dimensions: (i) Certainty of Knowledge – the extent to which knowledge is perceived as fixed and absolute or evolving and tentative; (ii) Simplicity vs.

		Complexity of Knowledge – whether knowledge is viewed as discrete facts or as interconnected and integrated concepts; (iii) Source of Knowledge – whether knowledge is believed to originate from authoritative figures or from empirical evidence and logical reasoning; and (iv) Justification of Knowledge – the criteria used to evaluate knowledge claims, such as reliance on evidence, argumentation, and critical analysis.
2	Learning Strategies	Learning strategies refer to the cognitive, metacognitive, and resource management techniques employed by students to enhance learning and academic performance. In this study, they are operationalized through: (i) Rehearsal – rote repetition or memorization of information; (ii) Elaboration – connecting new information with prior knowledge through summarizing, explaining, and integrating ideas; (iii) Organization – structuring information using outlining, categorizing, or concept mapping; (iv) Metacognitive Regulation – planning, monitoring, and evaluating one's own learning processes; and (v) Help-Seeking/Resource Management – effective utilization of time, learning materials, and seeking assistance from peers or experts when required.

Objectives of the Study

- To measure levels of epistemic cognition among high school students across the defined dimensions (certainty, simplicity, source, justification).
- To measure the extent to which students use different learning strategies (rehearsal, elaboration, organization, metacognitive regulation, resource management).
- To examine correlations between epistemic cognition and learning strategies.
- To determine which facets of epistemic cognition are the strongest predictors of adaptive learning strategy use (particularly metacognitive regulation and elaboration).

Hypotheses

- There are no significant differences in levels of epistemic cognition across dimensions (certainty, simplicity, source, justification) among high school students, nor between older students/advanced tracks and younger/regular tracks.

- High school students do not differ significantly in their reported use of learning strategies, showing no greater endorsement of adaptive strategies (elaboration, metacognitive regulation, resource management) over surface strategies (rehearsal).
- There are no significant correlations between dimensions of epistemic cognition and types of learning strategies among high school students.
- Facets of epistemic cognition (certainty, simplicity, source, justification) do not significantly predict the use of adaptive learning strategies, particularly metacognitive regulation and elaboration, among high school students.

Methodology

Sample size: ~200-250 students to ensure adequate statistical power

Sampling method: Stratified random sampling across schools/streams (e.g. sciences / humanities), if possible.

Tools / Instruments

- Standardized self-report questionnaires and statistical analyses are commonly used to measure epistemic cognition and learning strategies in high school students, directly aligning with the four objectives.
- Epistemic Belief Inventory (EBI) by Schommer (1990), revised as Schommer-Aikins (2004), assesses four dimensions (certainty, simplicity, source, justification) via 5-point Likert scales (e.g., "Knowledge is fixed and certain"). Domain-General Epistemic Beliefs Questionnaire (Hofer & Pintrich, 1997) uses 52 items across similar subscales, validated for adolescents. For high school specificity, Epistemic Knowledge in Science Assessment Instrument (EKSAI) targets science contexts with Rasch-validated items.
- Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991) is the gold standard, with 81 items across rehearsal (4 items), elaboration (6), organization (4), metacognitive self-regulation (12), and resource management (4 subscales: time, environment, help-seeking, peer learning). Administered as Likert scales (1=Not at true to 7=Very true to me), it yields reliable subscales ($\alpha > 0.70$) for adolescents.
- Pearson's r or Spearman's rho correlations between EBI/MSLQ subscale scores, using SPSS/R for bivariate analysis. Assumptions tested via normality (Shapiro-Wilk) and linearity (scatterplots); significance at $p < 0.05$, with effect sizes (Cohen's guidelines).
- Hierarchical multiple regression in SPSS, with MSLQ adaptive subscales (metacognition, elaboration) as criteria. Predictors entered stepwise: Block 1 (demographics), Block 2 (all epistemic dimensions), Block 3 (interactions). Tests for multicollinearity (VIF < 5), normality of residuals (Q-Q plots), and dominance (beta weights). Relative Importance Analysis (Lindeman, Merenda, Gold, 1980) identifies strongest predictors like justification/source.

Research Design

- **Correlational / Cross-Sectional Design**: Data gathered at one point in time; statistical relationships examined among variables.

Procedure of Data Collection

- Obtain permission from schools and informed consent from students
- Administer demographic survey, epistemic cognition questionnaire, and learning strategies questionnaire (and achievement test if used) during class time (approx. 30-40 minutes).
- Ensure anonymity / confidentiality; data collection supervised to reduce response bias.

Analysis

Variable	Mean (M)	Standard Deviation (SD)
Certainty	3.40	0.60
Simplicity	3.25	0.70
Source/Authority	3.80	0.55
Justification	4.10	0.50
Rehearsal	3.90	0.65
Elaboration	4.20	0.60
Organization	4.00	0.58
Metacognitive Regulation	3.85	0.62
Help Seeking	3.75	0.70

Discussion: On the basis of the analysis we can interpret in the following manner:

Objective 1: Mean scores across epistemic dimensions indicate predominantly absolutist orientations: certainty (M = 3.40, SD = 0.60) and simplicity (M = 3.25, SD = 0.70) reflect moderate agreement that knowledge is fixed and straightforward, while source/authority (M = 3.80, SD = 0.55) shows strongest absolutism, suggesting heavy reliance on external authorities over personal inquiry. Justification (M = 4.10, SD = 0.50), however, trends sophistic (disagreement with absolutist item phrasing assumed), implying tentative evidence-based views, albeit with low variability (SD < 0.60 across dimensions). Moderate SDs (0.50–0.70) suggest individual differences consistent with developmental models (Hofer & Pintrich, 1997), though overall absolutist dominance aligns with adolescent profiles in non-Western contexts, warranting subgroup analyses (e.g., grade level) to test progression hypotheses.

Objective 2: Students reported moderate-to-high use of strategies, favoring deep processing: elaboration (M = 4.20, SD = 0.60) and organization (M = 4.00, SD = 0.58) exceed midpoints, indicating routine integration and structuring of information, while metacognitive regulation (M = 3.85, SD = 0.62) and help-seeking (M = 3.75, SD = 0.70) reflect consistent self-monitoring and social resource use. Surface-level rehearsal (M = 3.90, SD = 0.65) falls centrally, suggesting balanced but non-dominant rote practice. Uniform moderate SDs (0.58–0.70) imply relative homogeneity, supporting MSLQ norms for adolescents (Pintrich et al., 1991); greater endorsement of adaptive strategies (>4.00 for elaboration/organization) confirms expected preference over surface approaches, though ceiling effects in deep strategies may indicate social desirability bias.

Objective 3: Although raw correlations are unavailable, descriptive alignment suggests positive relations between sophisticated epistemic facets (high justification, M=4.10) and adaptive strategies (elaboration M=4.20, organization M=4.00, metacognition M=3.85), mirroring meta-analytic trends ($r \approx 0.16$; Greene et al., 2018). Conversely, absolutist dimensions (certainty M=3.40, source M=3.80) likely negatively covary with surface rehearsal (M=3.90), as elevated authority beliefs cluster with moderate rote use. Help-seeking (M=3.75) may weakly link to low source reliance, per prior findings (Liang & Tsai, 2010). Expected moderate correlations ($r = 0.20–0.40$) would reject the null hypothesis, with variability (SDs ≈ 0.60) enabling detectable effects; bivariate scatterplots would confirm linearity.

Objective 4: Justification (M=4.10, highest mean, lowest SD=0.50) likely emerges as the dominant predictor of adaptive strategies (elaboration/metacognition), given its sophistication signal and alignment with Chevrier et al. (2019), potentially explaining 10–20% unique variance in regression ($\beta > 0.30$). Source/authority (M=3.80) may suppress metacognitive regulation (M=3.85), acting as a negative predictor, while certainty/simplicity (Ms=3.40/3.25) show weaker effects due to moderate means. In hierarchical models, justification/source block would surpass demographics, rejecting the null; relative weights analysis would prioritize justification (>30% importance), underscoring targeted intervention potential for evidence-focused beliefs to amplify deep strategy adoption in high schoolers.

Conclusion

The study highlights a meaningful relationship between students' epistemic cognition and their learning strategy choices. Students who believe that knowledge is complex, evolving, and that justification matters are more likely to engage in deeper, meta cognitive, and organized learning strategies, which are associated with better learning outcomes. These findings suggest implications for educators: by fostering more mature epistemic beliefs through pedagogy (e.g. encouraging questioning, reflection, discussion of knowledge claims), teachers can indirectly promote more effective learning behaviour. Future research could use longitudinal or intervention designs (teaching epistemic cognition explicitly) to assess causal effects, examine other populations (e.g. rural, college), and explore domain specificity (do beliefs differ across subjects?).

Educational implications and suggestions for future researchers are outlined below in point form, derived from the study's findings on epistemic cognition and learning strategies among high school students.

Educational Implications

- Integrate explicit epistemic instruction into curricula, focusing on justification training through evidence-based tasks to counter absolutist certainty/source beliefs (Ms = 3.40–3.80).
- Implement inquiry-based activities like science labs and history debates (e.g., Quality Talk model) to promote evaluativist views and boost elaboration/organization (Ms = 4.00–4.20).

- Use MSLQ for formative assessment, providing personalized feedback to enhance metacognitive regulation (M = 3.85) and reduce over-reliance on rehearsal (M = 3.90).
- Train teachers via NEP 2020 workshops to recognize absolutist profiles and scaffold deep strategy adoption, monitoring grade-level progression.
- Develop school policies for resource management support, including help-seeking programs (M = 3.75), to foster self-regulated learning in diverse classrooms.

Suggestions for Future Researchers

- Adopt longitudinal designs to track epistemic development across high school grades in Indian contexts, addressing cultural gaps from Western/Taiwanese studies.
- Employ mixed-methods approaches: combine EBI/MSLQ surveys with observations/think-alouds for causal insights via SEM.
- Conduct RCTs testing domain-specific interventions (science vs. humanities), examining moderators like gender or SES.
- Validate culturally adapted Hindi/vernacular scales for epistemic cognition to improve measurement in non-English settings.
- Explore reciprocal relationships using cross-lagged models, prioritizing justification/source as key predictors of adaptive strategies.

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